

WHAT IS CLAIMED IS:

1. A method of registering frames of film with respect to an aperture in a motion picture projector, comprising:

- 5 a. applying registration information to the film corresponding to the location of the frames on the film;
- b. moving the film through the projector and intermittently stopping the film frame-by-frame with respect to the aperture;
- 10 c. reading the registration information associated with each frame prior to projection to determine the location of the frame with respect to the aperture;
- d. determining the amount of correction that is necessary to achieve proper registration of the frame with respect to the aperture prior to projection; and
- 15 e. moving the frame into proper registration with respect to the aperture prior to projection.

2. A system for registering frames of film in a motion picture film projector having a gate for receiving film during intermittent advancement of the film through the projector, comprising:

- 20 a. an actuator connected to the gate that is adapted to move the gate relative to the aperture;
- b. a sensor that reads registration information on the film associated with each frame to determine the location of the frame with respect to the aperture prior to projection; and
- 25 c. a registration processor connected to the sensor and the actuator that is adapted to determine the amount of movement that is necessary to move the gate and thus the frame into proper registration with respect to the aperture.

3. The system of Claim 2, wherein the actuator comprises a piezoelectric motor.

30 4. The system of Claim 2, wherein the actuator comprises a piezoelectric motor flexure stage.

5. The system of Claim 2, wherein the actuator comprises a moving coil motor.

6. The system of Claim 2, wherein the registration information applied to the film comprises a registration reference mark that is read by the sensor.

5 7. The system of Claim 6, wherein the registration reference mark comprises a plurality of geometric shapes.

8. The system of Claim 7, wherein the geometric shapes comprise at least a circle and square.

9. The system of Claim 8, wherein the geometric shapes further comprise a triangle.
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10. The system of Claim 2, wherein the registration information is applied to the film in a space between adjacent frames on the film.

11. The system of Claim 2, wherein the sensor comprises a light-based sensor.

12. The system of Claim 11, wherein the light-based sensor comprises an LED array and a CCD array.
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13. The system of Claim 12, wherein the light-based sensor further comprises a mirror for reflecting light transmitted from the LED array onto the CCD array.

14. The system of Claim 2, further comprising redundant sensors adapted to read redundant registration information associated with each frame.
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15. The system of Claim 2, wherein the registration processor controls operation of the sensor and processes the registration information for each frame to determine the location of successive frames relative to the aperture.

16. The system of Claim 15, wherein the registration processor further determines the amount of film misregistration from one frame to the next and generates an output signal that is delivered to the actuator, and wherein the output signal commands the actuator to move the gate such that the frames are correctly registered with respect to the aperture.
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17. The system of Claim 16, wherein the output signal is a voltage based signal.
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18. The system of Claim 16, wherein the output signal is a current based signal.

19. The system of Claim 2, wherein the actuator is configured to move the gate in increments as small as approximately 0.000002 inches in about one millisecond or less.

20. The system of Claim 2, wherein the actuator and gate are configured such that the actuator can move the gate at least 0.006 inches in both the X direction and the Y direction.

21. A device for registering motion picture film in a projector, comprising:

a. a gate for receiving film and intermittently stopping frames of the film relative to an aperture, wherein the gate is moveable with respect to the aperture;

b. an actuator connected to the gate, wherein the actuator is configured to move the gate relative to the aperture; and

c. a processor that commands the actuator to move the gate relative to the aperture based on registration information on the film adjacent to the frames.

22. Motion picture film, comprising:

a. a length of motion picture film having a plurality of projectable images on the film, wherein each image is defined by a frame; and

b. registration information applied to the film adjacent to a plurality of the frames, wherein the registration information is located in the same position relative to each of the frames.

23. The motion picture film of Claim 22, wherein the registration information comprises information that is capable of being read by a sensor.

24. The motion picture film of Claim 23, wherein the registration information comprises a plurality of different shapes that are read by a light-based sensor.

25. The motion picture film of Claim 24, wherein the plurality of different shapes comprises at least a circle and a square or rectangle, and wherein the diameter of the circle is equal to the width of the square or rectangle.

26. The motion picture film of Claim 25, wherein the plurality of different shapes further comprises a triangle adjacent to the circle and the square or rectangle.

27. The motion picture film of Claim 22, wherein the registration information is located outside the frame.

5 28. The motion picture film of Claim 26, wherein the registration information is located in the space between adjacent frames.

29. The motion picture film of Claim 22, wherein redundant registration information is applied to the film for each frame.